Export-Led Growth and Geographic Distribution of the Poultry Meat Industry in Brazil

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Abstract

This paper includes an examination of the sustainability of recent high growth in the poultry meat industry in Brazil. In addition, an assessment is made of the impact of increased production of poultry meat products on the development of local industries. Comparative studies of leading companies in the United States, Mexico, and Brazil reveal competitive advantages in the low costs of feedstuff and labor as well as disadvantages in the scale of business and management efficiency in the Brazilian poultry sector. Increases in domestic and foreign demand for Brazilian poultry meat have promoted development of the Brazilian poultry sector in local areas. The formation of industrial clusters is observed using regional data related to the location of slaughterhouses and the number of chickens farmed. Statistical analyses support observations made in this paper.

Keywords: Brazil, poultry meat, regional development, clusters
JEL classification: C19, N56, O13, R12

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1. Introduction

Traditionally for developing countries, natural resource-based products are one of the major export items and sources of foreign exchange. However, unexpected fluctuations or long-lasting slumps in market prices often damage developing economies that chiefly depend on revenues from a limited number of primary commodities. In order to cope with these problems, developing countries often introduce various policies to develop the manufacturing sector and promote exports of processed products derived from primary commodities.

Even though developing countries make progress in the growth of export-oriented manufacturing industries (including high-tech sectors), there are often serious gaps between large cities and outlying regions. Large cities experience growth driven by the process of industrialization and export promotion, while outlying regions are supported by natural-based sectors and local-based small businesses. At present, closing these gaps has become an urgent political matter, and development of local industries is given high priority in the agenda of many developing countries.

Developing countries have instituted a number of industrial policies for promoting high-tech industries. However, recent increased demand for and consequent price increases in natural resources have benefited developing countries, especially in South America (ECLAC 2004, 2005). In countries where the economy has depended heavily on primary resources, expansions in exports of natural resources have contributed to the growth of their national economies.

Under these conditions, the question arises as to whether or not the growth in exports of natural resource-based products will be sustainable, and whether or not increases in production of such export items will promote development of local industries. Even if there is a potentially large market, small businesses may have difficulty participating successfully. For example, small companies may not have the capability to meet hygiene control standards required by developed countries.

The above issues are examined in this paper through study of the Brazilian poultry meat industry. Section 2 concerns the world position of the Brazilian poultry meat industry and associated companies. Section 3 includes assessment of the structure of the poultry meat industry in Brazil, and a view of the geographic expansion of poultry production in Brazil is presented in Section 4. The final section includes a summary and conclusions.

2. Production of and Demand for Brazilian Poultry Meat

2.1 Increasing World Demand for Brazilian-Grown Chicken

According to FAOSTAT, in 2004, Brazil was the third largest chicken meat producer in the world. It produced 12.7 percent of the world's chicken meat. This followed the world production shares of the United Sates (22.7 percent) and China (14.5 percent). Table 1 shows a large gap between production in Brazil and in Mexico, the fourth largest producing country.

Larger concentrations may be observed in the export of chicken meat. For the first time in 2004, Brazil became the leading exporter and accounted for 33.2 percent of world chicken exports. The United States accounted for 32.1 percent. In total, these countries were responsible for 65 percent of world exports. On the other hand, exports from China accounted for only 1.4 percent (3.2 if exports from Hong Kong are included).

Rankings of chicken meat producing and exporting countries have gradually changed from around the year 2000 when Brazil stared increasing its exports (Figures 1 and 2). A part of this rapid growth may be due to depreciation of the national currency in the early 2000's.[1] Nevertheless, radical change followed the outbreak and spread of avian influenza that originated in East and Southeast Asia at the end of 2003.

An obvious impact of avian influenza was observed in chicken meat imports of Japan. Until 2003, Thailand and China were respectively the first and third largest chicken meat suppliers to Japanese consumers. In 2004, imports from these countries decreased sharply. Resulting shortages in the chicken supply were filled primarily by Brazil. The quantity of Brazilian meat exports to Japan doubled between 2003 and 2005. As a result, Brazilian products comprised 90 percent of chicken meat imports into Japan in 2005. Chile, the Philippines, Argentina, and Poland also increased exports to Japan (Table 2).

The Middle East, Asia, and the European Union are the major foreign markets for the Brazilian chicken meat industry. About 30 percent of Brazilian chicken meat exports (on a weight basis) were shipped to the Middle East. This was followed by 26.6 percent to Asia and 13.6 percent to the European Union (UBA 2005).

[1] Annual average exchange rates [Brazilian real (R$) / US dollar (US$) – selling] were 1.8302 (2000), 2.3504 (2001), 2.9212 (2002), 3.0783 (2003), 2.9259 (2004), and 2.4352 (2005) (Source: IPEA, Banco Central do Brasil).

2.2 Production and Market Trends in Brazil

Views of the Brazilian poultry industry different from the above may be obtained if historical data is used and comparisons with other meat producing industries in Brazil are made. It appears that growth in chicken production was based on stable domestic demand and rapidly increased with external demand.

Production, Domestic Demand, and Export

Growth in chicken meat production in Brazil had been based on the rapid expansion of domestic demand in the 1990's. Production, consumption, and export all grew at an annual rate of 9.9 percent between 1986 and 1999. During the same period, production rose by 241.7 percent; 208.0 percent was due to domestic demand and 33.8 percent to increase in exports (Figure 3).

From 2000 to 2005, production grew at an annual rate of 9.2 percent. Domestic consumption rose by 5.2 percent annually, and the annual average rate for exports was 25.7 percent. During these years, production increased 55.5 percent; 24.5 percent of this was due to consumption and 32.4 percent to exports (Figure 3).

Changes in the role of exports can also be seen in the percentage of exports relative to production. This ratio had ranged from 10 to 15 percent between 1986 and 1999. The export ratio passed 15 percent in 2000 for the first time and reached 30 percent in 2005.

Comparisons among Chicken, Beef, and Pork

During the past 20 years, the per capita consumption of chicken meat has grown at a higher rate than that of other meats. In 1986, the average Brazilian consumed 30 kilograms of beef, 10 kilograms of chicken, and 7 kilograms of pork. In 2005, the per capita consumption of chicken reached 35.4 kilograms, nearing the rate of 36.3 kilograms of beef consumption. The increase in pork consumption was more moderate than that of chicken (Figure 4).

During the last 10 years, chicken meat has been the most important export among meat products in both weight and value. The export value of chicken remained unchanged in the latter half of the 1990's. It was 881 million US dollars in 1996 and 921 million in 1999. The figure reached 3,496 million US dollars in 2005. Exports of other meats also jumped, especially in the early 2000's. As a result, the percentage of exports of chicken meat relative to total meat exports dropped from 73.6 percent in 1996 to 49.7 percent in 2005 (Figure 5).

3. Structure of the Poultry Meat Industry

In order to respond to increasing demands for the Brazilian poultry meat, it is necessary to establish the capability to have a sufficient supply. An efficient production system is also required for the Brazilian poultry meat industry to be competitive in the international market. This section examines production scale, supply chains, and comparative advantages of Brazilian companies.[2]

3.1 Characteristics of Major Brazilian Poultry Slaughterers

Brazilian Poultry Slaughterers in the Americas

Rapid expansion of poultry meat production enabled Brazilian companies to boost production capacities. As seen in Table 3, local companies in Brazil established a large production scale compared to companies in Latin America. Three leading Mexican companies also produced a comparably high number of broilers relative to Brazilian producers. However, two of the Mexican companies (Pilgrim's Pride, Tyson) are actually from the United States. If the fact that the quantity of chicken meat production in Brazil was four times as large as Mexico is taken into account, the scale of Brazilian companies is not necessarily large.

The above is supported by a comparison of the poultry slaughter capacity of Perdigão, the second largest Brazilian company, and Tyson Foods, the top U.S. firm. Perdigão had a slaughter capacity of 10.2 million heads per week, while Tyson Foods could slaughter approximately 50 million per week in 2005. It is difficult to make direct comparisons of production capabilities of top companies in Brazil and the United States. However, it is possible to assume a difference in production scale between Sadia, the leading Brazilian company, and Tyson Foods. Sadia slaughtered 650.1 million heads of poultries in 2005 compared to Perdigão with 487.1 million during the same year.

In the following subsection, characteristics of the large Brazilian companies are examined in more detail. Specifically, Sadia and Perdigão are compared to leading United States and Mexican companies.

Major Brazilian Poultry Slaughterers in the Local Market

In contrast to situations in both Mexico and the United States, competition in the

[2] Hamaguchi (1988) examined factors that determined development of the broiler industry from the perspectives of geographic environment and conditions of supply and demand.

Brazilian poultry industry is strong. Only two Brazilian firms with poultry slaughterhouses had market shares of two-digits in 2005: Sadia with 14.2 percent and Perdigão with 11.3. Twenty major firms maintained more than one percentage each of the market share. However, the total shares of 50 companies did not reach 80 percent (Table 4).

Exporting companies are limited, and leading exporters take a larger share of total exports. Sadia exported 25.8 percent of total exports in 2005, followed by Perdigão (17.4 percent), Seara (12.4 percent), and Doux Frangosul (10.1 percent). The total share of these four companies accounted for 65.7 percent of total exports. Unlike production activity, 25 major exporting companies accounted for almost all exports (Table 5).

3.2 Integrated Supply Chain of the Poultry Business

The production of poultry products in Brazil is based on vertically integrated production systems. Sadia, founded as a wheat milling and hog-slaughtering firm in 1944 in the State of Santa Catarina, introduced such integrated production systems into Brazil. It did this when the company started poultry production and slaughter in 1961 (Tamai and Asaki, 2000).

In an integrated production system, large producers of poultry products own animal feed plants, hatcheries to produce one-day chicks, slaughterhouses, and distribution centers. They negotiate contracts with growers to raise commercial poultry. These large firms provide the integrated poultry farmers with one-day chicks and feedstuff as well as veterinary and technical support. This enables the poultry products industry to supervise poultry breeding. Growers that have been contracted are paid fees based on performance indicators such as bird mortality, feed to meat conversion ratios, and average weight. Fees paid to integrated farmers cover their production costs and net profits.

According to Sadia (*2004 Annual Report*), the company's production process for poultry consists of four stages: The first two are for producing grandparent and parent stock that entail direct investment by Sadia. The third is related to the commercial stock of birds and involves integrated farmers. The last is the slaughtering process. Sadia imports eggs of grandparent stock from the United States to hatch in its hatcheries and raise newborn birds on its own farms. Perdigão purchases breeder chicks and eggs from Cobb do Brazil, an affiliate of Cobb-Vantress. This is a subsidiary of Tyson Foods (Perdigão Form 20-F for 2005). These birds produce parent-breeding stock raised on farms owned by Sadia. One-day chicks produced by the parent stock are supplied to

out-growers. The company has contracts with approximately 6,600 out-growers with no employment agreements. Most farm on a small scale and raise six flocks per year (each flock consists of approximately 14,000 chickens). It normally takes 36 days for out-growers to deliver grown chickens at a weight of 2.0 kilograms to Sadia's slaughterhouses. The slaughtered birds are distributed to the consumer market as fresh meat or are used as raw material for processed products (Figure 6).

A similar integrated production system can be introduced by the production of eggs as well as turkey and pork meats. In practice, there are poultry slaughterers who also produce eggs, turkey, pork, beef, milk, and processed products. In the case of pork meat, major poultry meat exporting companies are also listed as important pork exporters. In 2004, Sadia exported 19.3 percent of the total volume of Brazilian pork. Figures for Perdigão and Seara were 17.4 and 17.2 percent respectively (Perdigão SEC Filing Form 20-F for 2004).

3.3 Comparative Advantages of the Brazilian Poultry Industry

Cost and Efficiency of Poultry Production

High growth in the Brazilian poultry industry in the 1990's was supported by productivity improvements achieved by the introduction of foreign technology, low production costs, and increases in domestic and foreign demand (Tamai and Asaki, 2000).

Horne (2002) estimated total production costs, primary production costs, and processing costs of broiler meat for 1999. He did this in order to compare costs in France, the United Kingdom, Germany, the Netherlands, the United States, and Brazil. There were clear differences in production costs between the European and the two Non-European countries. Production costs in the United States and in Brazil were respectively 30 and more than 40 percent lower than those in Europe. Low costs in the United Sates and Brazil were attributed to low feed prices with local access to feed ingredients such as corn and soybeans as well as to low chick costs due to efficient integrated production. Labor cost is a major part of the meat processing stage, and Brazil had a strong advantage on a global basis. The favorable climate in Brazil helped to reduce housing costs.

There is also evidence regarding improvement in the production efficiency of Brazilian companies for the last 30 years. In the case of Sadia, during the period between 1975 and 2004, the market age (production cycle days) was shortened from 59.3 to 35.8 days, the slaughter weight of poultry was increased from 1.7 to 2.0

kilograms, and the feed conversion ratio (quantity of feedstuff required to produce one unit of meat) improved from 2.4 to 1.8 (Sadia *2004 Annual Report*). Copacol, between 1983 and 2005, succeeded in improving the market age from 52 to 45 days, the average weight from 1,770 to 2,526 grams, and the feed conversion ratio from 2.260 to 1.852 (website of Copacol). The market age in the United States was 56 days in 1975, 53 days in 1980, and 44 days in 2005. The U.S. market weight increased to 1,705.5 grams in 1975, 1,782.6 grams in 1980, and to 2,381.4 grams in 2005. During the same years, the feed conversion ratio in the United States improved to 2.10, 2.05, and to 1.90 (Website of National Chicken Council). The mortality rate of chickens is necessary to evaluate production efficiency correctly. Though this was not taken into account, Brazilian companies seem clearly to have caught up with the United States broiler industry.

Performance at the Level of Firms

Financial data for 2004 (Table 6) is useful for comparing performance in the meat product businesses of Sadia and Perdigão to Tyson Foods and Bachoco, the leading meat product companies in the United States and Mexico respectively.

A marked difference in scale of business can be identified from sales volume. The operating revenue of Sadia was less than one tenth that of Tyson Foods. However, revenues of Sadia and Perdigão exceeded that of Bachoco. Total assets of Sadia are one fifth those of Tyson Foods. Indicators related to income, profit, and number of employees, also show how much smaller the scale of business of Brazilian meat products is compared with the top U.S. Company.

Lower production costs for the Brazilian meat industry may be implicitly observed from the ratio of cost of goods sold to operating revenue. Ratios for the two Brazilian firms were around 70 percent, while indicators for Tyson Foods and Bachoco were higher than 80 percent. Nevertheless, Brazil's advantages seem to be eroded by inefficiency in management. The ratio of total operating expense to operating revenue in Brazil was close to 20 percent, and this was much higher than the 3.7 percent for Tyson Foods and 12.5 percent for Bachoco.

Fewer assets and less property coupled with smaller plants and less equipment per employee in Brazilian firms reflect the labor intensiveness of the Brazilian meat industry. In addition, they reveal the industry's dependency on lower material costs to compete in the world market.

Some information based on segments is available to compare the poultry businesses of Sadia and Tyson Foods. Sales and operating revenue from poultry meat for 2005 were respectively 1,367 million and 115 million US dollars for Sadia. They

were 8,295 million and 582 million US dollars for Tyson Foods. The ratios of operating income to revenue were respectively 8.4 percent for Sadia and 7.0 percent for Tyson. Although the absolute value of profit performance for Sadia was smaller than that of Tyson Foods, it was not inferior (Table 7).

4. Geographic Expansion of Poultry Production

Some attention must be given to regional economic development. This is examined here with focus primarily on spatial distributions of poultry slaughterhouses and the number of farm-raised chickens. Indirect impact of growth in the chicken meat industry on the regional economy must be carefully investigated.

4.1 Location of Poultry Slaughterhouses

Historically, according to Tamai and Asaki (2000), the integrated production system was developed in the Southern Region and diffused nationwide. The two major meat producers, Sadia and Perdigão, were founded within this region in Santa Catarina. Similar to Sadia, Perdigão was founded in 1934 and started hog slaughtering in 1939. It began poultry slaughtering in 1955. These companies in the Southern Region set up operations and introduced the integrated production system to the Southeast where large cities such as São Paulo (SP) and Rio de Janeiro (RJ) were located. Historically, this was another center of chicken meat production. In the 1990's, these slaughterers then expanded their operations into the Midwest Region in areas such as Mato Grosso (MT) and Mato Grosso do Sul (MS). This expansion was bolstered by the following factors: (1) availability of grains such as soybeans and corn, (2) low costs of land, labor, and feedstuff, (3) great potential for local demand, and (4) local governmental incentives for industrial promotion.

In order to show progress in the geographic expansion of slaughterhouses, the locations of 84 slaughterhouses owned by the 50 major poultry producers for 2004/2005 and listed in Table 4 (with years of their establishment), are illustrated in Figure 7 and mapped in Figure 8.[3] Viewing Figure 7, it can be seen that early established

[3] Data on the year of establishment was obtained from the SIGSIF (Sistema de Informações Gerencias do Serviço de Inspeção Federal) database of the Ministry of Agriculture (Ministério da Agricultura, Pecuária e Abastecimento) of the Government of Brazil. The database provides two types of yearly information related to slaughterhouses: (1) the date of reserve (Data de Reserva) and (2) the date of register (Data de Registro). An earlier date was used as a rough measure for the year of establishment. Data on slaughterhouses used for analysis in this paper are related to slaughterhouses owned by the 50 major producers. Data does not include all poultry slaughterhouses in Brazil or other meat processing plants. Thus, the production facility in the Federal District (DF) leased by Perdigão for poultry processing is not included. The national map can be divided into 5,560 administrative municipal areas.

slaughterhouses were located in the States of Paraná (PR), Rio Grande do Sul (RS) and Santa Catarina (SC) in the South. In addition, two waves of establishments appeared. During the first wave in the 1970's, more slaughterhouses were established in the three states in the South and Southeast such as Minas Gerais (MG) and São Paulo (SP). Locations of these establishments were dispersed into the Midwest during the second wave in the 1990's. Although states in the South and the Southeast remained important areas for chicken meat production, new slaughterhouses were opened in the Midwest such as in Goiás (GO), Mato Grosso (MT) and Mato Grosso do Sul (MS).

Figure 8 includes a map of these processes. The 84 slaughterhouses in this figure are located in 80 different municipalities. There are two concentrations of the slaughterhouses: (1) the area in the South between the northeastern part of Rio Grande do Sul and the southwestern part of Paraná, and (2) the area in the State of São Paulo. Figure 8 indicates that older slaughterhouses were established in these two areas, and newer slaughterhouses were built in the Midwest (GO, MT, and MS) after the 1990's.

In 1997, Perdigão launched an investment plan called the "Expansion 2003 Plan". During the period from 1997 to 2003, the company invested 399 million Brazilian real to construct "the Rio Verde Agroindustrial Complex" in Rio Verde in the State of Goiás. This complex is composed of feed mills and facilities for poultry and hog slaughtering and processing. Following the "Expansion 2003 Plan", the company further expanded the Rio Verde Agroindustrial Complex in the period from 2004 through 2006.

Perdigão has also announced the construction of the new Agroindustrial Complex of Mineiros in the State of Goiás for poultry slaughtering and processing. This complex is expected to reach full capacity by December 2008. In the State of Mato Grosso, this company acquired Abatedouro Mary Loize in the municipality of Nova Mutum in June 2005 to meet the demand for chicken meat exports (Perdigão SEC Filings Form 20-F 2004, 2005).

In 2005, Sadia merged with Só Frango, a company based in Brasilia. Through this acquisition, Sadia strengthened its presence in the central area of Brazil, an area closer to raw material producers and to Brazil's main centers of consumption. With its out-growers, Sadia also has a plan to invest in the State of Mato Grosso in the period from 2006 to 2009. The plan is to construct two poultry slaughterhouses, one in the city of Lucas do Rio Verde and the other in the city of Campo Verde (Sadia SEC Filings Form 20-F 2004, 2005).

4.2 Spatial Pattern of the Number of Raised Chickens

Production capacity of poultry meat was observed in the above subsection. Changes in the slaughter capacity have an impact on chicken meat production and the number of chickens grown in farms.

Change in the Chicken Meat Production by Federal Units

Regional distributions of poultry exports have changed in the last few years. As shown in Table 8, the States of Paraná, Rio Grande do Sul, and Santa Catarina were responsible for about 50 percent of the total production, and they accounted for 97 percent of the total exports from Brazil in 2000. Although national share of the production of these three states in the South remained at about 50 percent, Santa Catarina's share in exports dropped dramatically from 45.4 percent in 2000 to 27.9 percent in 2005. However, during the same period, regional shares in total export increased from 1.5 to 8.5 percent for São Paulo and 1.4 to 12.1 percent for the rest of the states.

Facing increases in demand from home and abroad, the Southern States pursued export-led growth and took advantage of their ample experience in transactions with the market abroad. Between 2000 and 2005, Santa Catarina achieved a growth rate in production of 24.4 percent.[4] Of this, domestic shipments contributed -1.2 percentage points; shipments abroad accounted for 25.6 percentage points. Rio Grande do Sul depended more on exports. While the state achieved a 29.2 percent increase in production, domestic shipments made a negative contribution of 7.3 percent points. The positive contribution of exports (36.5 percentage points) counteracted the negative impact of domestic shipping. In other states, contributions of domestic and foreign shipments were more balanced. As a result, although 83 percent of total production in Rio Grande do Sul was shipped to domestic markets, the percentage dropped to 58.6. São Paulo's high ratio of 84.9 percent of production was distributed within Brazil.

Similar to Table 8, Table 9 provides information for the years 2003 and 2005; national production is further classified into states of the Midwest. Table 9 shows that domestic shipments contributed to growth in production in São Paulo and its neighbor states (GO, MG). The contribution of exports was more important in states of the South and in newly developing grain-growing regions (MS, MT). For example, in the State of Goiás, 25.1 percent growth in production was realized; the contribution of domestic shipments was 16.4 percent and that of exports was 8.7 percent.

[4] Per-head weight of chicken was assumed to be 2.5 kilograms in order to convert the number of heads into the weight of production.

Data shown above indicates that the Southern Region still maintains a comparative advantage as a base of operations for export. This region seems to have a better logistic infrastructure and appears to be an important route for shipping meats produced in inland areas abroad. In practice, top exporting companies still invest in facilities within this region. Perdigão shipped 45 percent of its exports through the port of Paranaguá in the State of Paraná (where the firm owns refrigerated warehouses) and 35 percent through the ports of São Francisco do Sul and Itajaí in the State of Santa Catarina (Perdigão SEC Filing Form 20-F 2004).

Geographic Distribution of the Farm-fed Chickens

Again similar to Figure 8, data on the number and the increase in number of cocks, young chickens, and chicks (hereafter chickens in this subsection) for 2002 and 2004, are mapped in Figure 9. A layer of slaughterhouse locations, as drawn in Figure 8, is added. The geographic scope of the data includes 11 states in the Southern, Southeastern, and Midwestern Regions that are divided into 3,319 municipalities. Data related to the number of chickens is based on Produção da Pecuária Municipal (PPM) for 2002 and 2004.

Figure 9 shows that chicken farming is concentrated around the slaughterhouses of the 50 major slaughterers. Larger increases in the number of chickens are also distributed around these facilities. Although dimensions of the municipalities in the Midwest tend to be larger than those in the South and Southeast, there are fewer municipalities that breed larger numbers of chickens in comparison with regions in the South and Southeast. For this reason, in the following analysis, data on the number of chickens were not normalized (by dimension or population of municipality, for example).

In order to confirm geographic patterns in the distribution of number of chickens and their increase between 2002 and 2004, Moran's I and local Moran's I were calculated using *GeoDa* (Anselin *et al*, 2004). The spatial weight matrix used for these calculations is contiguity-based. For a specific municipality, its neighboring municipalities have a value of 1 or 0. Moran's I assumes values between -1 and 1. If this measure is near 0, the data analyzed is randomly distributed. If values are near 1, similar values of the data, either high or low, are found together. If the value of Moran's I is near -1, high and low values are interspersed. A large positive value for local Moran's I for a specific municipality indicates that the municipality is surrounded by municipalities with similar values (Mitchell 2005, pp.121-4, 167).

Moran's I for the number of chickens in 2002 was 0.25. The values for 2004 and

for the increase between 2002 and 2004 were 0.28 and 0.07 respectively. This indicates that clustering of chicken breeding made some progress. The increase in farmed chickens appears randomly distributed. The LISA maps in Figures 10, 11, and 12 depict locations with significant local Moran statistics at the 5 percent level and provide a classification of those locations by type of association.

Maps for the number of chickens in Figures 10, 11, and 12 show that there are areas classified as “high-high” (municipalities with higher values are surrounded by others with higher values) in and around municipalities where slaughterhouses are located. Large clusters are especially found in the Eastern Rio Grande do Sul, the Western Santa Catarina and Paraná, the Southern Mato Grosso do Sul, and the State of São Paulo.

However, locations of high-high areas that are areas with larger increases in the number of chickens, do not necessarily coincide with the location of slaughterhouses or the spatial clusters of the number of raised chickens seen in Figures 10, 11, and 12. The high-high locations, or spatial clusters, revealed by the LISA map form the core of the clusters. Thus, if “high-high” areas in terms of increase in the chickens are located around spatial clusters of chicken breading, chicken farming clusters may be expanding spatially. Such distributions can be found, for example, in Eastern São Paulo depicted in Figure 12.

5. Concluding Remarks

Recently, the Brazilian poultry meat industry has benefited from increased demand for reliable meat supplies from the Northern Hemisphere as well as a preference of the Brazilian people for poultry meat. High growth in this sector has had a positive impact on the development of local industries.

As shown by LISA and other maps, there are industrial clusters formed by poultry meat producers in the South and in the Midwest (one of the most important grain-growing regions in the world), as well as in São Paulo (a major domestic market). Using their comparative advantages, the first two regions concentrate their production capacities on serving foreign consumers. Producers in São Paulo and neighboring states pay more attention to the local market in addition to overseas markets.

Rapid growth in production and export of poultry meat products indicates a bright future for the Brazilian poultry meat sector. However, some doubt still remains about the sustainability of such rapid growth. A key issue may be the cost competitiveness of Brazilian companies. Accounting data shows that the

competitiveness of Brazilian companies may come from the low price of homegrown grains and lower labor costs. Brazil does not have a strong comparative advantage in labor cost if its legal minimum wage is compared with its competitors (in 2005, 300 Brazilian real [about 130 US dollars] per month in Brazil as compared with 180 Baht [4.4 US dollars] per day in Thailand for example). Costs related to transportation and fluctuations in foreign exchange rates are also important in evaluating the competitiveness of Brazilian products against rivals from Asia.

Brazilian companies also have disadvantages in both scale of business and in efficiency at the management level. In comparison with leading companies in the United States and Mexico, the local market in Brazil is shared by a greater number of smaller indigenous producers. In addition, Brazilian firms must meet the strict quarantine regulations of developed countries and establish production facilities flexible enough to satisfy rapid growing demands. These, of course, require a larger scale of production and more fund-raising ability. These issues pose threats of market reorganization to Brazilian slaughterers. It is difficult to forecast whether these possible threats will be turned into reality by top Brazilian firms or by multinational corporations. It is difficult to forecast if such reorganization would be encouraged by top Brazilian firms or by multinational corporations. Evidence may be found supporting both, and it is interesting to note specifically the mergers and acquisitions (M&A's) of Seara by Cargill, of Só Frango by Sadia, and of Abatedouro Mary Loize by Perdigão.[5]

Consumers will no doubt avoid the risk of depending on a sole supplier of poultry meat products. Further, the possibility that avian influenza may spread in Brazil cannot be denied. Such can certainly provide business opportunities for other developing countries, including those in Latin America.

[5] In July 2006, Sadia announced a voluntary public offer for the acquisition of control of Perdigão.

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Table 1 Chicken Meat Production, Exports and Imports for 2004 in the World and Latin America (in 10,000 tons)

Production			Export			Import		
Country		**(%)**	**Country**		**(%)**	**Country**		**(%)**
World	6,844.9	100.0	World	730.8	100.0	World	655.2	100.0
United States	1,551.4	22.7	Brazil	242.5	33.2	Russia	99.9	15.3
China	989.5	14.5	United States	234.3	32.1	Hong Kong	50.2	7.7
Brazil	866.8	12.7	Netherlands	51.5	7.1	Saudi Arabia	42.7	6.5
Mexico	222.5	3.2	France	34.4	4.7	Japan	35.4	5.4
India	165.0	2.4	Belgium	33.8	4.6	United Kingdom	34.2	5.2
United Kingdom	128.8	1.9	United Kingdom	19.0	2.6	Mexico	31.1	4.7
Spain	126.8	1.9	Germany	16.3	2.2	Ukraine	27.6	4.2
Japan	124.2	1.8	Hong Kong	12.9	1.8	China	23.0	3.5
Indonesia	119.1	1.7	Denmark	12.2	1.7	Germany	22.6	3.5
Russia	115.2	1.7	China	9.9	1.4	Netherlands	22.3	3.4
Latin America	1,568.9	100.0	Latin America	254.4	100.0	Latin America	64.3	100.0
Brazil	866.8	55.2	Brazil	242.5	95.3	Mexico	31.1	48.4
Mexico	222.5	14.2	Argentina	6.5	2.5	Cuba	11.4	17.7
Argentina	78.5	5.0	Chile	4.2	1.7	Guatemala	5.3	8.2
Colombia	70.9	4.5	Dominican Rep.	0.5	0.2	Jamaica	3.1	4.9
Venezuela	68.6	4.4	Mexico	0.3	0.1	Venezuela	2.4	3.7
Peru	64.3	4.1	Costa Rica	0.2	0.1	Haiti	1.7	2.7
Chile	44.6	2.8	Paraguay	0.1	0.0	Surinam	1.3	2.1
Ecuador	20.8	1.3	Honduras	0.1	0.0	Antilles	1.2	1.8
Dominican Republic	18.3	1.2	El Salvador	0.0	0.0	Bahama	0.9	1.5
Guatemala	15.5	1.0	Nicaragua	0.0	0.0	Chile	0.9	1.4
Latin America/World		22.9	Latin America/World		34.8	Latin America/World		9.8

Source: Author's calculation based on data of FAOSTAT (Website of FAO accessed on April 25, 2006).

Table 2 Chicken Meat Imports in Japan by Origin (in tons)

	1990	1995	2000	2001	2002	2003	2004	2005	1990-2005
Total	291,226	535,955	568,273	523,089	524,449	466,111	353,796	419,120	7,349,039
Brazil	40,579	94,439	112,933	109,217	168,158	174,942	296,053	378,466	2,011,280
United States	100,004	125,250	87,324	75,991	49,646	47,186	29,587	28,923	1,448,642
Chile	2,371	386	15			91	3,869	5,950	23,992
The Philippines			34	16	54	44	1,017	1,644	2,820
Argentina						50	291	1,134	1,640
Poland						0	309	1,020	1,329
China	34,914	196,951	238,216	188,801	118,998	62,928	8,420	976	1,977,914
Korea		5	167	116	195	359	52	289	1,552
Denmark	655	296	405	404	476	176	489	276	6,591
France	2,363	1,841	69	80	107	106	132	126	21,760
Taiwan	317	395	228	302	300	357	164	79	4,329
Hungary	346	46	71	108	175	104	101	64	1,585
Thailand	104,737	114,871	127,941	146,542	183,305	175,172	12,249	61	1,808,123
Dominica Rep.							21	42	63
Belize				41				25	93
Peru	1,766							23	3,306
Spain	22	9	3	6	6	16	18	21	136
Costa Rica								1	31
Indonesia	179	300	521	1,444	2,442	3,788	35		14,822
Mexico	2,533	164				25	261		11,877
Malaysia		131			368	645	651		2,599
Others	440	871	346	21	219	122	77	0	4,555

Source: Author's production based on statistics of the Ministry of Finance (MOF) (website of the MOF accessed on April 25, 2006).

Table 3 Leading Broiler Producers in Latin America

Company	Country	No. Broilers (1,000)
Sadia	Brazil	618,000
Perdigão	Brazil	546,000
Bachoco	Mexico	404,000
Frangosul (Doux)	Brazil	286,000
Seara (Cargill)	Brazil	273,000
Avipal	Brazil	225,000
Pilgrim's Pride de Mexico	Mexico	155,000
Tyson/Trasgo	Mexico	125,000
Dagranja	Brazil	105,000
Grupo San Fernando	Peru	102,000
Protinal/Proagro C.A.	Venezuela	98,000
Aurora	Brazil	95,000
Agrosuper	Chile	92,000
Corporación Avícola Jarabacoa (Pollo Cibao)	Dominican Rep.	80,000
Copacol	Brazil	75,000
Pena Branca	Brazil	75,000
Granja Tres Arroyos	Argentina	68,000
Ariztía	Chile	68,000
Grupo Monterrey	Mexico	68,000
Pronaca	Ecuador	60,000
Granja La Caridad	Venezuela	60,000
Rasic Hnos	Argentina	59,000
Avidesa	Colombia	52,000
Big Frango	Brazil	50,000
Sertanejo	Brazil	50,000
Grupo Pecuario San Antonio	Mexico	45,000
Lar	Brazil	44,000
Avícola Villalobos	Guatemala	42,200
Penasul Alimentos (OSI)	Brazil	42,000
PATSA	Mexico	40,000

Source: *Industria Avícola*, January 2006.

Table 4 The 50 Major Poultry Producers in Brazil for 2004 and 2005

Ranking		Firms	Poultry (Heads)		Growth	Share (%)
2004	2005		2005	2004	(%)	2005
(1)	1	Sadia	629,209,878	550,149,640	14.4	14.21
(2)	2	Perdigão	498,850,657	475,596,089	4.9	11.27
(3)	3	Seara	277,320,934	263,320,384	5.3	6.26
(4)	4	Frangosul	237,068,234	231,503,059	2.4	5.36
(5)	5	Avipal	208,096,594	187,653,021	10.9	4.70
(6)	6	Dagranja	117,199,849	114,056,368	2.8	2.65
(7)	7	Aurora	91,826,334	86,227,916	6.5	2.07
(8)	8	Diplomata	90,754,483	84,401,085	7.5	2.05
(9)	9	Penabranca	82,155,225	74,778,648	9.9	1.86
(10)	10	Copacol	72,080,048	62,029,390	16.2	1.63
(11)	11	Pif Paf	53,192,295	50,511,257	5.3	1.20
(12)	12	Sertanejo	48,703,960	47,193,539	3.2	1.10
(21)	13	Frango Forte	48,255,906	33,933,386	42.2	1.09
(14)	14	Big Frango / Jandelle	48,193,500	43,766,241	10.1	1.09
(13)	15	Kaefer Avicultura	47,976,472	44,392,807	8.1	1.08
(20)	16	Rei Frango	45,777,144	34,584,516	32.4	1.03
(17)	17	C.Vale	42,408,783	37,302,168	13.7	0.96
(16)	18	Penasul	42,325,268	39,841,177	6.2	0.96
(15)	19	Coop. Agroindl. Lar	41,075,461	40,149,388	2.3	0.93
(22)	20	Ad'oro	37,361,755	33,467,059	11.6	0.84
(18)	21	Avic. Céu Azul	37,103,020	34,730,072	6.8	0.84
(25)	22	Anhambi	35,222,181	30,000,979	17.4	0.80
(32)	23	Mat. Avic. Flamboiã	33,630,590	23,997,475	40.1	0.76
(33)	24	Avícola Paulista	32,865,286	23,856,551	37.8	0.74
(30)	25	São Salvador	32,411,121	24,972,297	29.8	0.73
(24)	26	Coopavel	32,202,400	30,490,758	5.6	0.73
(27)	27	Coperguaçú	31,404,872	28,863,670	8.8	0.71
(26)	28	Nutriza	31,033,287	29,088,658	6.7	0.70
(31)	29	Agrovêneto	27,313,146	24,381,138	12.0	0.62
(36)	30	Avicola Felipe	25,948,112	20,926,282	24.0	0.59

Table 4 (continued)

(29)	31	Macedo, Koerich	25,732,727	25,061,471	2.7	0.58
(28)	32	Comaves	25,371,320	26,419,987	(4.0)	0.57
(34)	33	Coop. R. A Languirú	24,053,657	22,405,371	7.4	0.54
(42)	34	Gonçalves & Tortola	22,491,460	17,904,060	25.6	0.51
(38)	35	Coroaves	21,872,592	20,019,340	9.3	0.49
(23)	36	Cotrel	21,636,506	30,726,919	(29.6)	0.49
(35)	37	Francap	21,115,438	21,042,228	0.3	0.48
(37)	38	Frangoeste	19,875,689	20,234,992	(1.8)	0.45
(39)	39	Coop. Holambra	19,847,930	19,746,255	0.5	0.45
(47)	40	Jaguafrangos	19,079,358	13,780,071	38.5	0.43
(44)	41	Nogueira Rivelli	18,745,645	15,866,008	18.1	0.42
(48)	42	Abat. Aves Ideal	18,612,494	13,489,094	38.0	0.42
(40)	43	Polifrigor	18,233,778	18,837,327	(3.2)	0.41
(41)	44	Frinal	18,172,072	18,125,677	0.3	0.41
(45)	45	Agrofrango	15,776,702	15,112,104	4.4	0.36
(46)	46	Notaro Alimentos	14,156,698	13,937,111	1.6	0.32
(49)	47	Votuporanga	13,746,750	13,067,272	5.2	0.31
NR	48	Palmali	13,603,752	11,146,442	22.0	0.31
(50)	49	Cossissa Agroindl.	12,938,041	12,717,121	1.7	0.29
	50	Real Alimentos	12,731,183	11,049,021	15.2	0.29
		Sub total	3,456,760,587			78.09
		Others	969,973,407			
		Total	4,426,733,994			

Source: UBA (União Brasileira de Avicultura) / ABEF (Associação Brasileira dos Produtores e Exportadores de Frangos) (UBA *Relatório Anual 2005/2006*).

Table 5 The 25 Major Brazilian Exporters of Poultry Products in 2005

No.	Firm	Export volume (ton)	Share in exports (%)
1	SADIA S/A	733,784	25.78
2	PERDIGÃO Agroindustrial S/A	495,146	17.40
3	SEARA Alimentos S/A	353,269	12.41
4	DOUX FRANGOSUL S/A Agroavícola Industrial	286,805	10.08
5	AVIPAL S/A Avicultura e Agropecuária	215,813	7.58
6	DIPLOMATA Industrial e Comercial Ltda.	75,225	2.64
7	Moinhos Cruzeiro do Sul S/A – PENABRANCA	65,514	2.30
8	Cooperativa Central Oeste Catarinense – AURORA	49,446	1.74
9	Avicultura Granja CÉU AZUL Ltda.	46,837	1.65
10	Cooperativa Agroindustrial LAR	45,750	1.61
11	PENASUL Alimentos Ltda.	44,462	1.56
12	DAGRANJA Agroindustrial Ltda.	42,792	1.50
13	C. VALE Cooperativa Agroindustrial	42,381	1.49
14	Cooperativa Agricola Consolata Ltda. – COPACOL	36,914	1.30
15	Agroavícola Vêneto Ltda. – AGROVENETO	33,994	1.19
16	Frango SERTANEJO Ltda.	26,694	0.94
17	BIG FRANGO – Indústria e Comércio de Alimentos Ltda.	24,834	0.87
18	MACEDO KOERICH S/A	23,401	0.82
19	Cooperativa LANGUIRU Ltda.	21,972	0.77
20	Cooperativa Agropecuária Cascavel Ltda. – COOPAVEL	18,760	0.66
21	PALMALI Industrial de Alimentos Ltda.	14,232	0.50
22	Nogueira Rivelli Irmãos Ltda – FRANGOBOM	13,478	0.47
23	Rio Branco Alimentos S/A – PIF PAF	10,008	0.35
24	COSSISA Agroindustrial S/A	9,183	0.32
25	VOSSKO do Brasil Alimentos Congelados Ltda.	7,469	0.26
	Subtotal	2,738,163	96.21
	Others	107,783	3.79
	Ground total	2,845,946	100.00

Source: UBA/ABEF (UBA *Relatório Anual 2005/2006*).

Table 6 Financial Data of Leading Meat Products Companies in the Americas for 2004 (in million US Dollars)

	Sadia	Perdigão	Tyson Foods	Bachoco
Operating Revenue/Sales	2,302	1,840	26,441	1,193
Cost of goods sold	(1,617)	(1,331)	(24,550)	(967)
Gross Profit	684	509	1,891	225
Selling, General and administrative expenses	(451)	(321)	(880)	(149)
Other operating expense, net	6	(3)	(86)	
Total operating expenses	(445)	(324)	(966)	(149)
Operating Income	239	140	925	77
Net Income	184	111	403	63
Total Current Assets	1,527	478	3,532	410
Property, plant and equipment, net	357	346	3,964	738
Total Assets	2,197	951	10,464	1,205
Number of Employees	40,600	31,406	114,000	18,896
Poultry sales/Total sales (%)	40.8	37.5	31.6	78.5
Growth in Operating Revenue for 2000-2004 (2000=1)	2.1	2.8	3.6	1.2
Growth in Operating Income for 2000-2004 (2000=1)	7.0	7.2	2.7	0.5
Cost of goods sold/Operating Revenue (%)	70.3	72.3	92.8	81.1
Total operating expenses/Operating Revenue (%)	19.3	17.6	3.7	12.5
Operating Income/Operating Revenue (%)	10.4	7.6	3.5	6.4
Property, plant and equipment, net/Employees (US$1,000)	8.8	11.0	34.8	39.1
Total Assets/Employees (US$1,000)	54.1	30.3	91.8	63.8
Operating Income/Total Assets (%)	10.6	14.0	8.8	6.4
Operating Income/Operating Revenue (%)	10.4	7.6	3.5	6.4
Operating Revenue/Total Assets	1.0	1.8	2.5	1.0

Notes: 1) Local currency-denominated figures were converted. Exchange Rates (end of 2004) were as follows: R$2.6544/US$, Ps.$11.15/US$.

2) Perdigão values are in accordance with the Brazilian generally accepted accounting principles (GAAP). Bachoco values are in accordance with the Mexican GAAP. Tyson data ended October 1, 2004.

3) Poultry sales for Sadia, Perdigão, and Tyson Foods do not include processed products. Bachoco's classification is unclear, but the portion does not seem to be significant.

4) With the acquisition of beef and pork powerhouse, IBP, Inc., Tyson becomes the world's largest processor and marketer not only of chicken, but also red meat.

Source: Author's calculation based on SEC Filings (Form 20-F, 10-K)

Table 7 Segment Information for Leading Meat Products Companies in the Americas for 2005

		Poultry	Beef	Pork	Processed Products	Others	Total
Sadia	Net Operating Revenue	1,366.8		313.0	1,344.6	102.2	3,126.6
	Operating income	115.3		40.4	116.9	1.2	273.8
	Operating income/Revenue (%)	8.4		12.9	8.7		8.8
Tyson	Sales	8,295	11,618	3,247	2,801	53	26,014
	Operating income	582	(12)	47	78	70	765
	Operating income/Sales (%)	7.0		1.4	2.8		2.9
Bachoco	Net revenues	1,208.9				152.3	1,361.1
	Gross profit	359.9				22.1	382.0
	Gross profit/Revenue	29.8				14.5	28.1

Notes: 1) Bachoco's poultry segment is composed of chickens and eggs. "Others" basically refers to swine and feed.

2) Values for Sadia and Bachoco are as of and for the year ending December 31, 2005.

3) Sadia values are in accordance with the Brazilian GAAP.

Source: Author's calculation based on SEC Filings Form 20-F (Sadia, Tyson), 10-K/A (Tyson Foods).

Table 8 Production and Export of Poultry Meat by States in 2000 and 2005

	2000			2005		
Quantity of Poultry Production (1000t)	**Production**	**Domestic**	**Exports**	**Production**	**Domestic**	**Exports**
Parana	1,511.8	1,257.5	254.3	2,526.6	1,735.5	791.1
Santa Catarina	1,491.0	1,079.3	411.7	1,854.9	1,062.0	792.8
Rio Grande co Sul	1,264.8	1,049.7	215.1	1,633.6	956.9	676.7
Sao Paulo	1,057.0	1,043.8	13.2	1,596.6	1,355.0	241.6
Others	2,786.0	2,773.6	12.4	3,455.2	3,111.5	343.8
Total	8,110.5	7,203.8	906.7	11,066.8	8,220.9	2,845.9
	2000			**2005**		
Share (within States)	**Production**	**Domestic**	**Exports**	**Production**	**Domestic**	**Exports**
Parana	100.0%	83.2%	16.8%	100.0%	68.7%	31.3%
Santa Catarina	100.0%	72.4%	27.6%	100.0%	57.3%	42.7%
Rio Grande co Sul	100.0%	83.0%	17.0%	100.0%	58.6%	41.4%
Sao Paulo	100.0%	98.8%	1.2%	100.0%	84.9%	15.1%
Others	100.0%	99.6%	0.4%	100.0%	90.1%	9.9%
Total	100.0%	88.8%	11.2%	100.0%	74.3%	25.7%
	2000			**2005**		
Share (between States)	**Production**	**Domestic**	**Exports**	**Production**	**Domestic**	**Exports**
Parana	18.6%	17.5%	28.0%	22.8%	21.1%	27.8%
Santa Catarina	18.4%	15.0%	45.4%	16.8%	12.9%	27.9%
Rio Grande co Sul	15.6%	14.6%	23.7%	14.8%	11.6%	23.8%
Sao Paulo	13.0%	14.5%	1.5%	14.4%	16.5%	8.5%
Others	34.4%	38.5%	1.4%	31.2%	37.8%	12.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	2000-2005					
Growth Rate	**Production**	**Domestic**	**Exports**			
Parana	67.1%	38.0%	211.1%			
Santa Catarina	24.4%	-1.6%	92.6%			
Rio Grande co Sul	29.2%	-8.8%	214.6%			
Sao Paulo	51.0%	29.8%	1730.0%			
Others	24.0%	12.2%	2672.3%			
Total	36.5%	14.1%	213.9%			
	2000-2005					
Contribution	**Production**	**Domestic**	**Exports**			
Parana	67.1%	31.6%	35.5%			
Santa Catarina	24.4%	-1.2%	25.6%			
Rio Grande co Sul	29.2%	-7.3%	36.5%			
Sao Paulo	51.0%	29.4%	21.6%			
Others	24.0%	12.1%	11.9%			
Total	36.5%	12.5%	23.9%			

Note: The weight of production was calculated assuming 2.5 kilograms per head.

Source: Author's calculation based on the ABEF data.

Table 9 Production and Export of Poultry Meat by States in 2003 and 2005

	2003			2005		
Quantity of Poultry Production (1000t)	**Production**	**Domestic**	**Exports**	**Production**	**Domestic**	**Exports**
Parana	2,033.4	1,536.7	496.7	2,526.6	1,735.5	791.1
Santa Catarina	1,621.9	1,009.4	612.5	1,854.9	1,062.0	792.8
Rio Grande do Sul	1,505.5	957.6	548.0	1,633.6	956.9	676.7
Sao Paulo	1,168.0	1,104.1	63.9	1,596.6	1,355.0	241.6
Minas Gerais	582.6	529.9	52.7	677.3	583.6	93.6
Goias	345.1	286.0	59.0	431.6	342.7	89.0
Mato Grosso do Sul	280.2	237.3	42.9	307.0	240.4	66.6
Mato Grosso	165.8	126.8	39.0	168.9	107.7	61.2
Others	1,581.6	1,574.4	7.2	1,870.5	1,837.1	33.4
Total	9,284.2	7,362.2	1,922.0	11,066.8	8,220.9	2,845.9
	2003			**2005**		
Share (within States)	**Production**	**Domestic**	**Exports**	**Production**	**Domestic**	**Exports**
Parana	100.0%	75.6%	24.4%	100.0%	68.7%	31.3%
Santa Catarina	100.0%	62.2%	37.8%	100.0%	57.3%	42.7%
Rio Grande do Sul	100.0%	63.6%	36.4%	100.0%	58.6%	41.4%
Sao Paulo	100.0%	94.5%	5.5%	100.0%	84.9%	15.1%
Minas Gerais	100.0%	91.0%	9.0%	100.0%	86.2%	13.8%
Goias	100.0%	82.9%	17.1%	100.0%	79.4%	20.6%
Mato Grosso do Sul	100.0%	84.7%	15.3%	100.0%	78.3%	21.7%
Mato Grosso	100.0%	76.5%	23.5%	100.0%	63.8%	36.2%
Others	100.0%	99.5%	0.5%	100.0%	98.2%	1.8%
Total	100.0%	79.3%	20.7%	100.0%	74.3%	25.7%
	2003			**2005**		
Share (between States)	**Production**	**Domestic**	**Exports**	**Production**	**Domestic**	**Exports**
Parana	21.9%	20.9%	25.8%	22.8%	21.1%	27.8%
Santa Catarina	17.5%	13.7%	31.9%	16.8%	12.9%	27.9%
Rio Grande do Sul	16.2%	13.0%	28.5%	14.8%	11.6%	23.8%
Sao Paulo	12.6%	15.0%	3.3%	14.4%	16.5%	8.5%
Minas Gerais	6.3%	7.2%	2.7%	6.1%	7.1%	3.3%
Goias	3.7%	3.9%	3.1%	3.9%	4.2%	3.1%
Mato Grosso do Sul	3.0%	3.2%	2.2%	2.8%	2.9%	2.3%
Mato Grosso	1.8%	1.7%	2.0%	1.5%	1.3%	2.1%
Others	17.0%	21.4%	0.4%	16.9%	22.3%	1.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

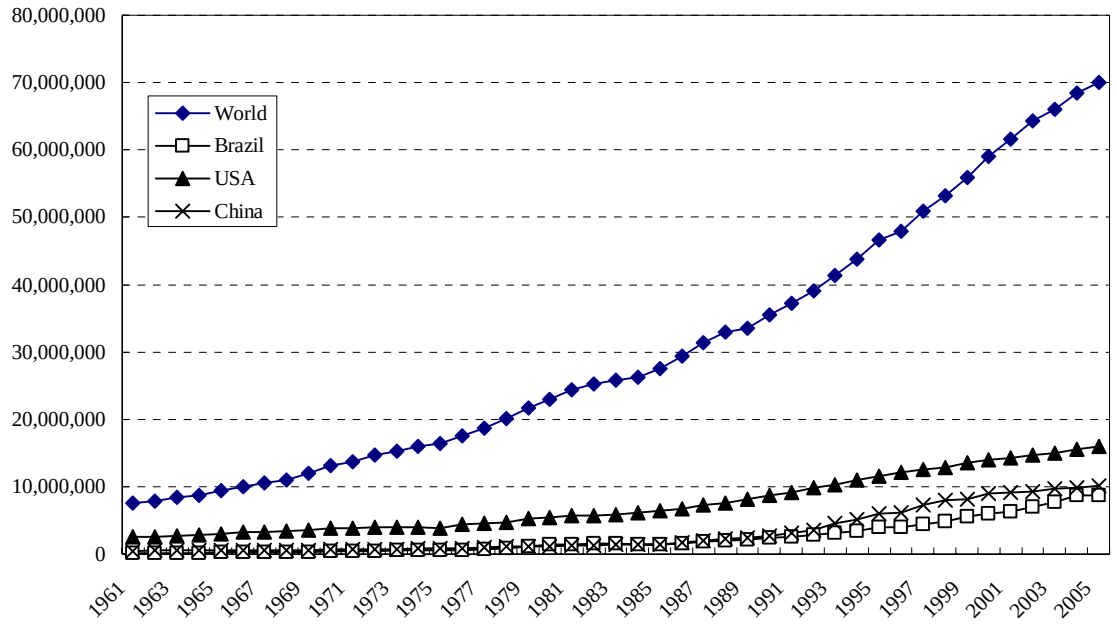
Table 9 (continued)

Growth Rate	2003-2005 Production	Domestic	Exports
Parana	24.3%	12.9%	59.3%
Santa Catarina	14.4%	5.2%	29.4%
Rio Grande do Sul	8.5%	-0.1%	23.5%
Sao Paulo	36.7%	22.7%	277.9%
Minas Gerais	16.2%	10.1%	77.7%
Goias	25.1%	19.8%	50.7%
Mato Grosso do Sul	9.5%	1.3%	55.0%
Mato Grosso	1.8%	-15.1%	56.8%
Others	18.3%	16.7%	363.3%
Total	19.2%	11.7%	48.1%
Contribution	**2003-2005 Production**	**Domestic**	**Exports**
Parana	24.3%	9.8%	14.5%
Santa Catarina	14.4%	3.2%	11.1%
Rio Grande do Sul	8.5%	0.0%	8.5%
Sao Paulo	36.7%	21.5%	15.2%
Minas Gerais	16.2%	9.2%	7.0%
Goias	25.1%	16.4%	8.7%
Mato Grosso do Sul	9.5%	1.1%	8.4%
Mato Grosso	1.8%	-11.5%	13.4%
Others	18.3%	16.6%	1.7%
Total	19.2%	9.2%	10.0%

Note: The weight of production was calculated assuming 2.5 kilograms per head.

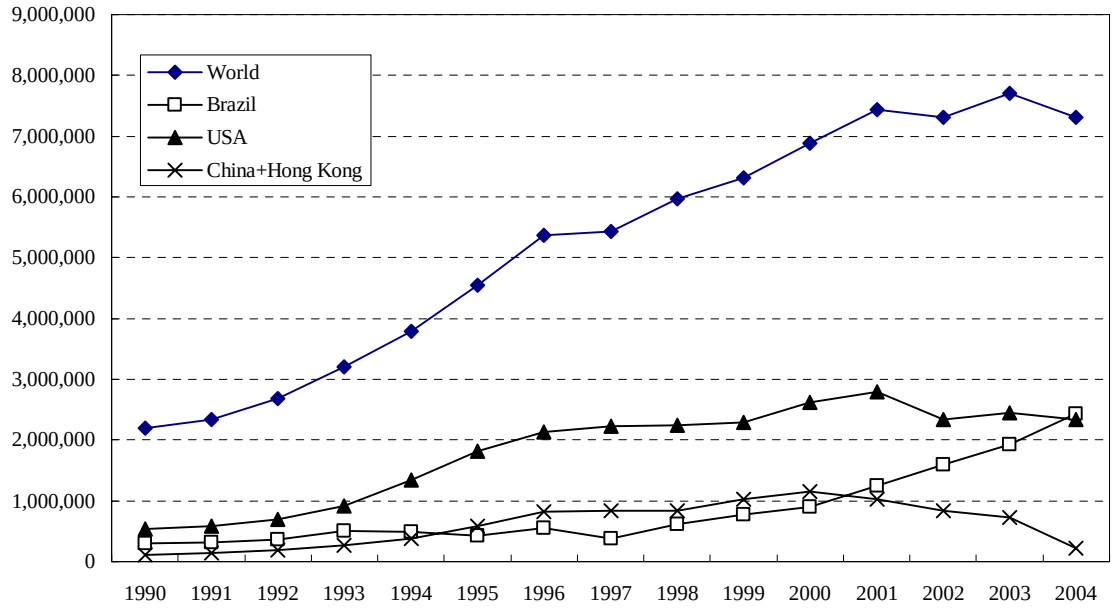
Source: Author's calculation based on ABEF data.

Figure 1 Chicken Meat Production (in tons)



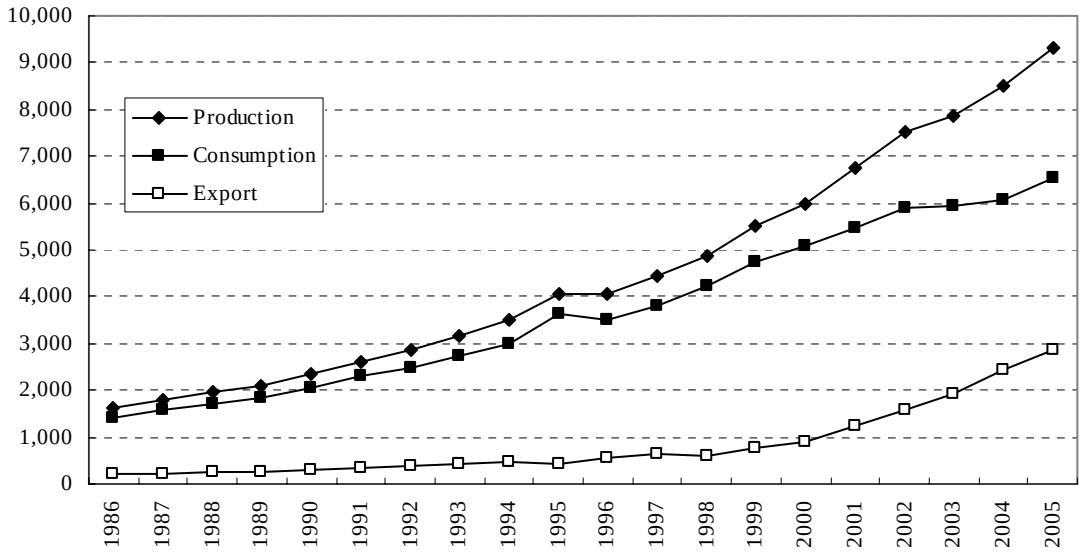
Source: Author's production based on data of FAOSTAT (Website of FAO accessed on April 25, 2006)

Figure 2 Chicken Meat Exports (in tons)



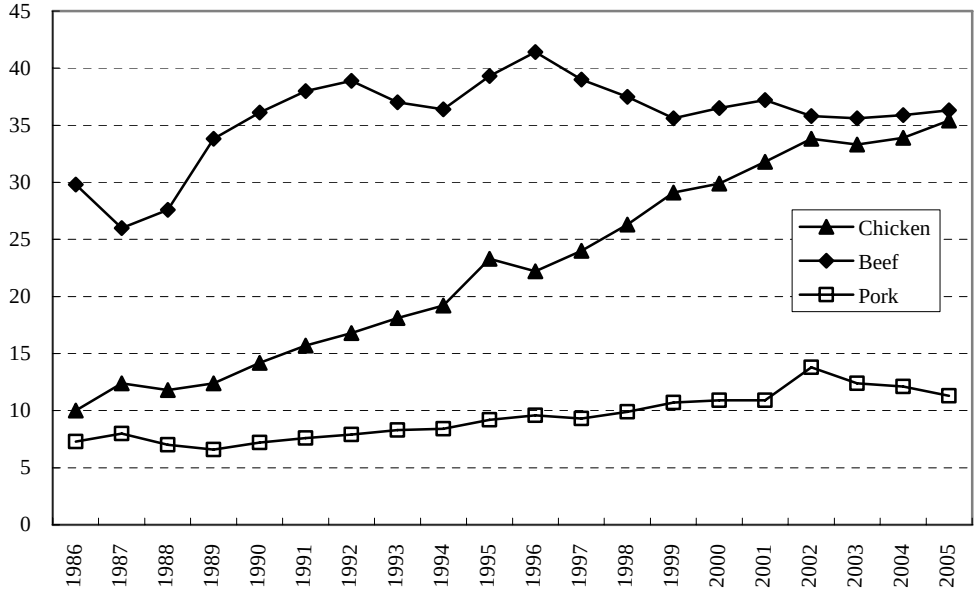
Source: Author's production based on data of FAOSTAT (Website of FAO accessed on April 25, 2006)

Figure 3 Production, Consumption, and Export of Chicken Meat in Brazil (in 1,000 tons)



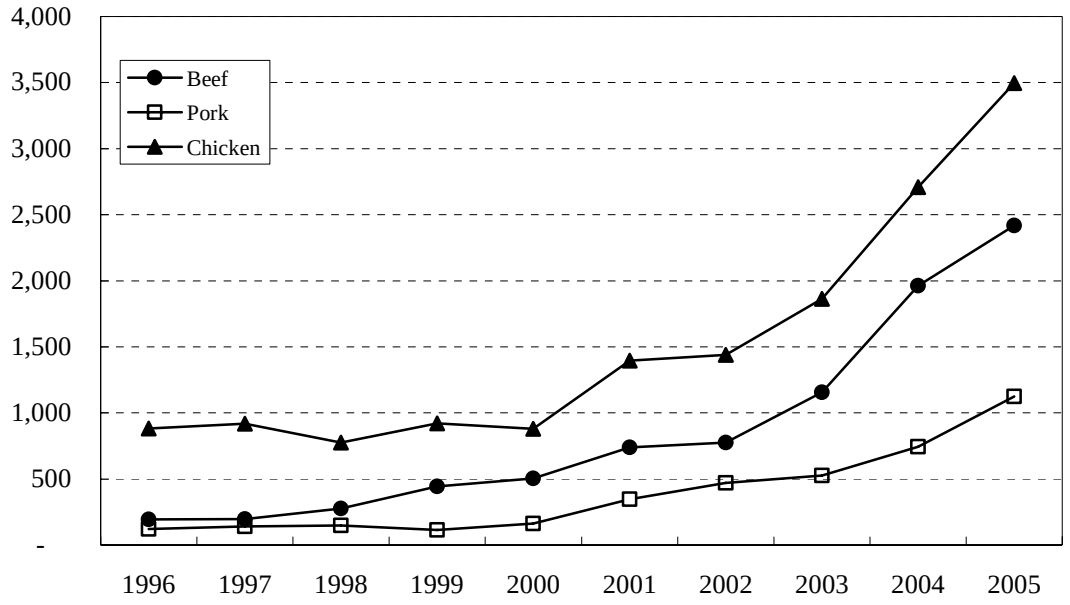
Source: Author's production based on UBA (*Relatório Anual 2005/2006*).

Figure 4 Per Capita Meat Consumption in Brazil (in kilograms)



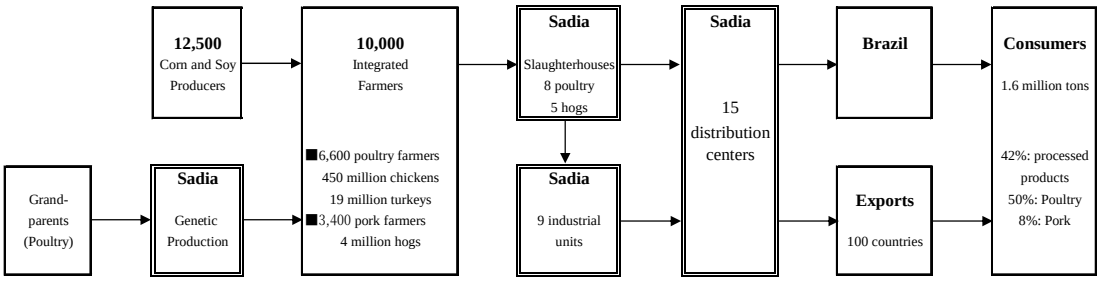
Source: Author production based on UBA (*Relatório Anual 2005/2006*).

Figure 5 Meat Exports (in Million US dollars, FOB)



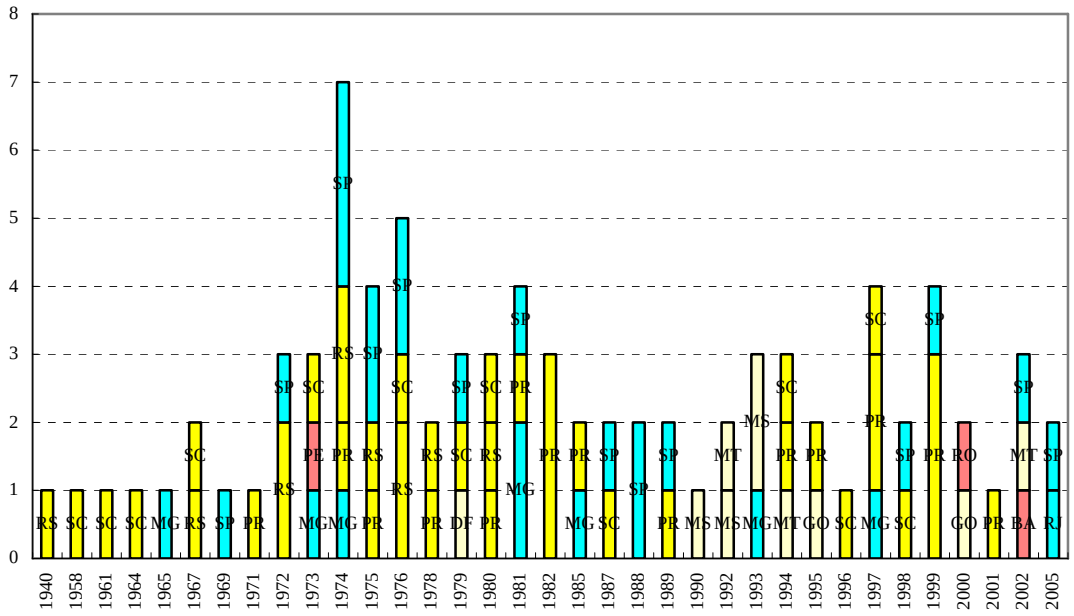
Source: Author's production based on data downloaded from Ministry of Agriculture (accessed on May 23, 2006).

Figure 6 Sadia's Integrated Supply Chain in 2004



Source: Author, based on the Sadia *Annual Report 2004*.

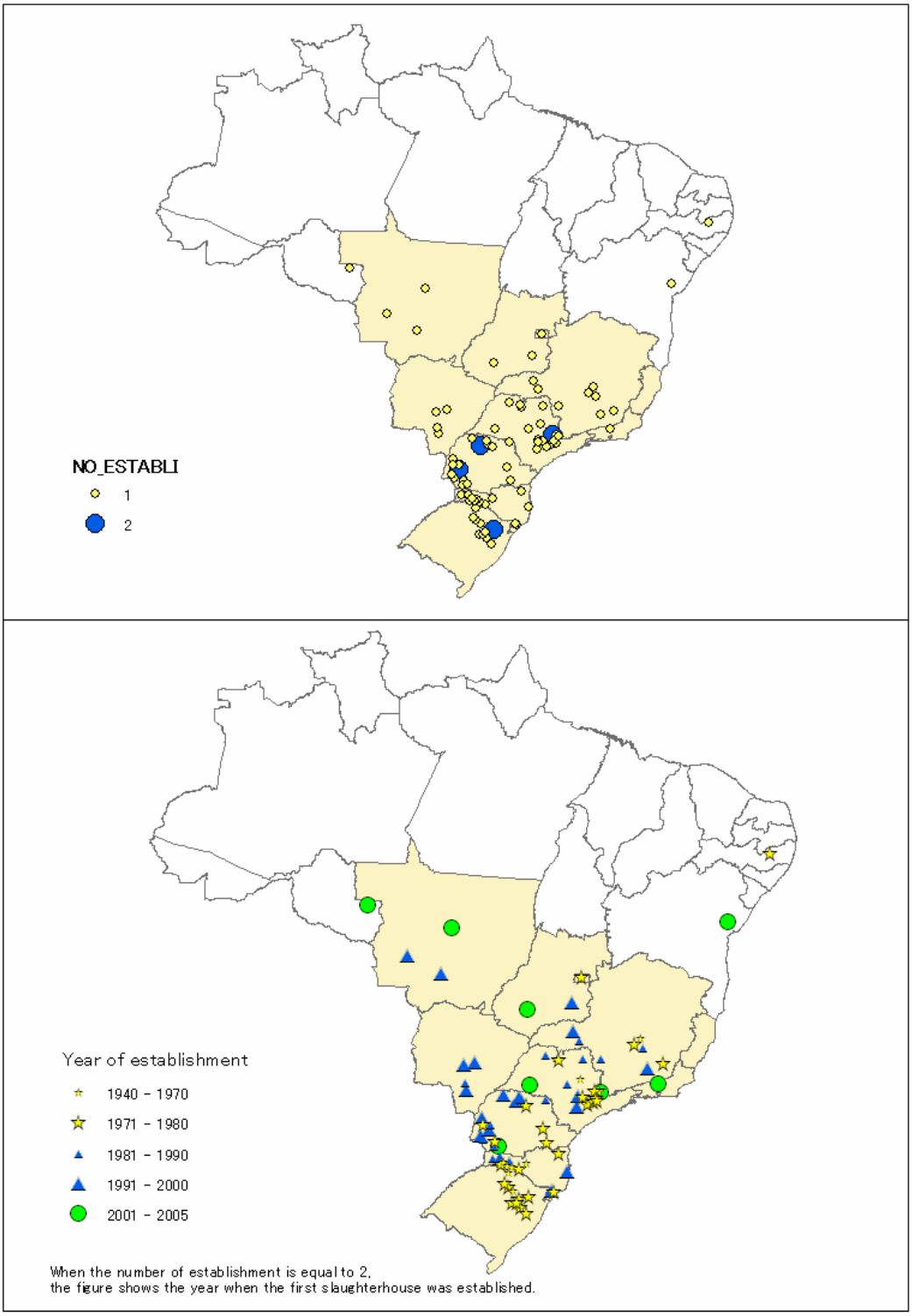
Figure 7 Establishment of Poultry Slaughterhouses by States



Note abbreviations as follows: BA (Bahia), DF (Distrito Federal), GO (Goiás), MG (Minas Gerais), MS (Mato Grosso do Sul), MT (Mato Grosso), PE (Pernambuco), PR (Paraná), RJ (Rio de Janeiro), RS (Rio Grande do Sul), SC (Santa Catarina), SP (São Paulo).

Source: Author's production based on SIGSIF (Sistema de Informações Gerencias do Serviço de Inspeção Federal) (accessed on June 21-23, 2006).

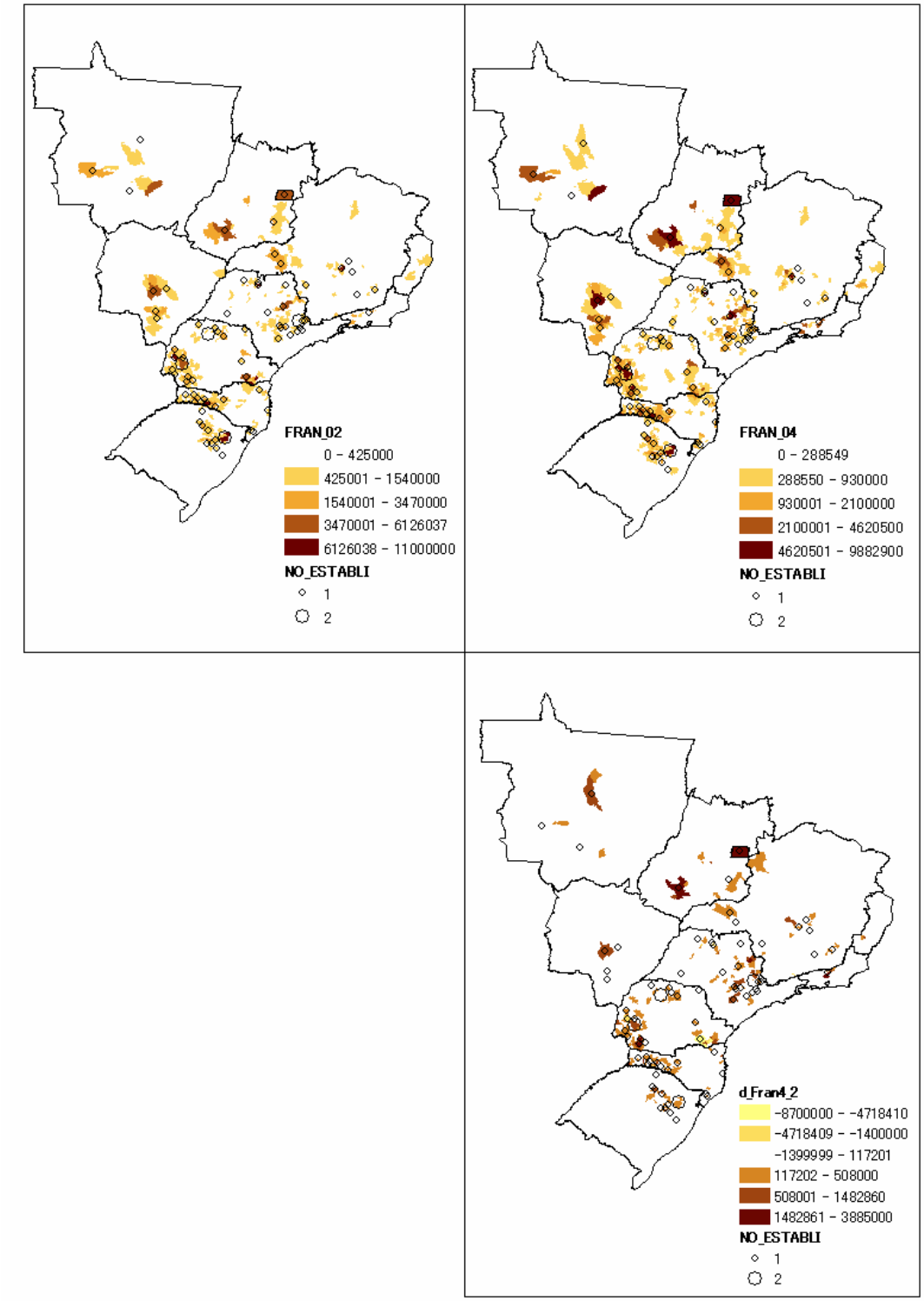
Figure 8 The Number (upper) and Year (lower) of Establishment Slaughterhouses of the 50 Major Poultry Producers



Note: The colored States are located in the Southern, Southeastern, and Midwestern Regions.

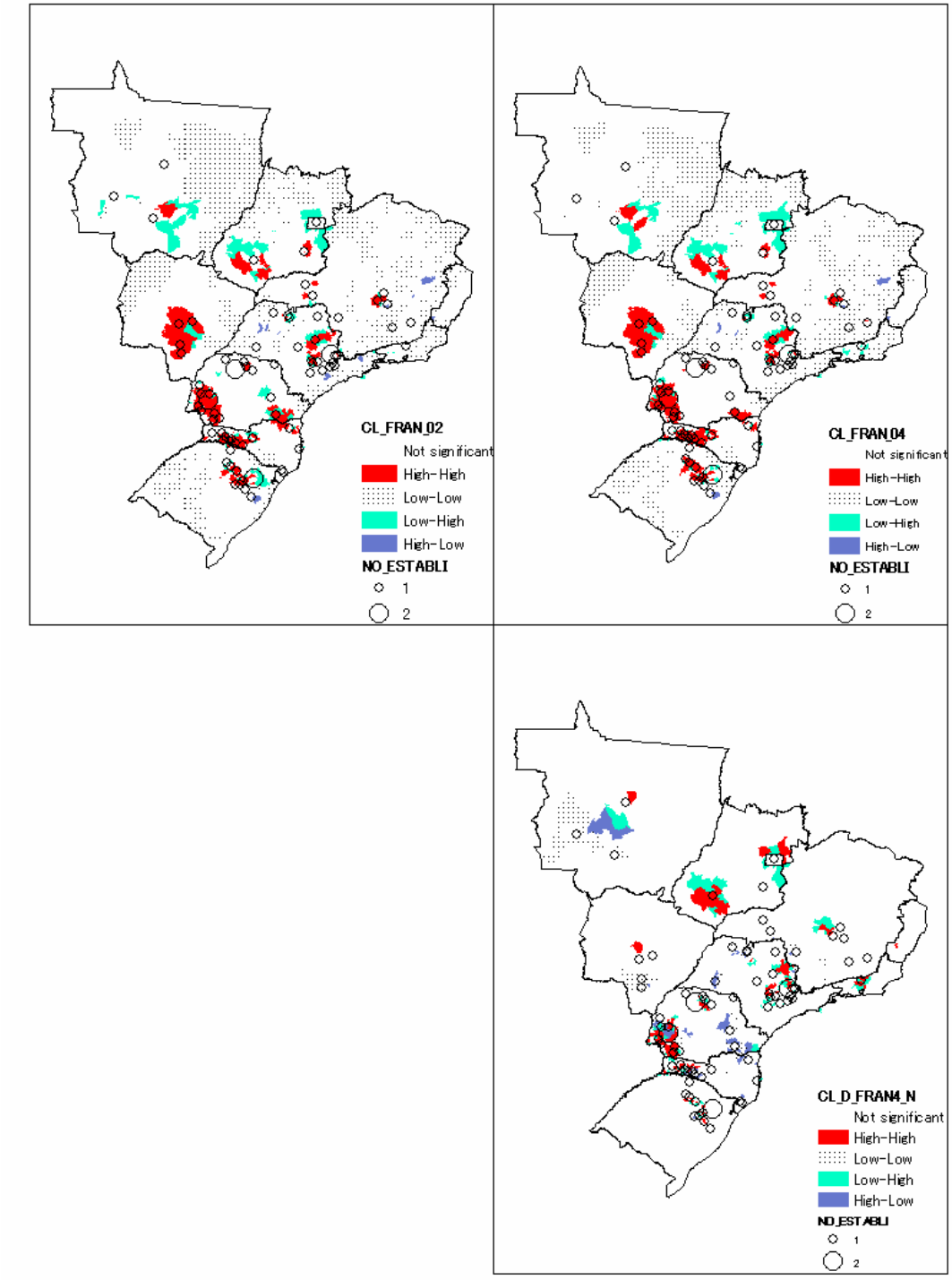
Source: Author.

Figure 9 The Number of Chickens for 2002 (upper left) and 2004 (upper right), and their Increase between 2002 and 2004 (lower right) in the Southern, Southeastern, and Midwestern Regions



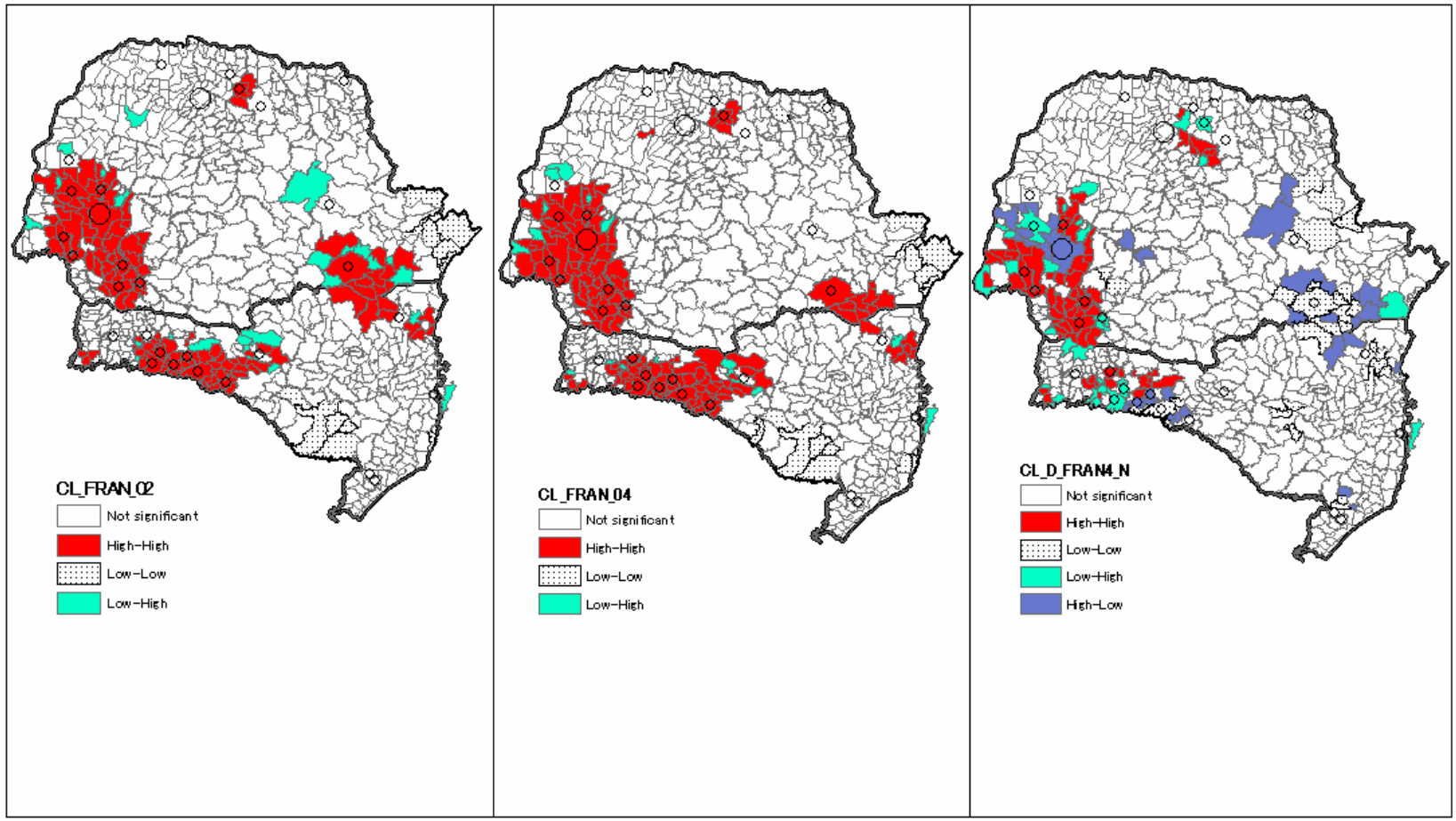
Source: Author.

Figure 10 LISA Cluster Maps for the Number of Chickens for 2002 (upper left), 2004 (upper right), and their Increase between 2002 and 2004 (lower right)



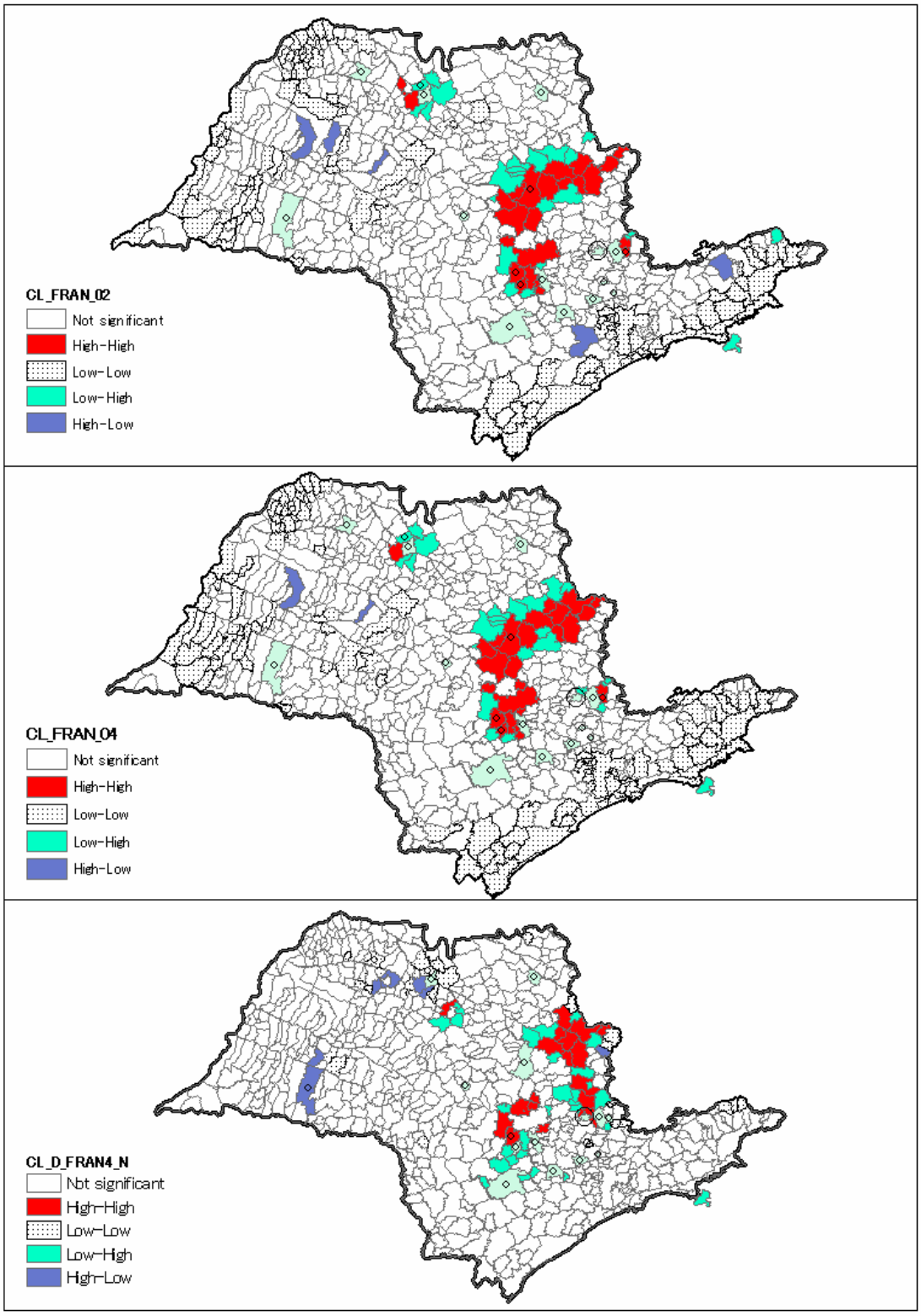
Source: Author.

Figure 11 LISA Cluster Maps for Paraná and Santa Catarina: the Number of Chickens for 2002 (left), 2004 (center), and the Increase in Number between 2002 and 2004 (right)



Source: Author.

Figure 12 LISA Cluster Maps for São Paulo: the Number of Chickens for 2002 (upper), 2004 (middle), and the Increase in Number between 2002 and 2004 (lower)



Source: Author.

Annex Map of Brazil

Region	States	Abbreviation	Region	States	Abbreviation
North	Rondônia	RO	Southeast	Minas Gerais	MG
	Acre	AC		Espírito Santo	ES
	Amazonas	AM		Rio de Janeiro	RJ
	Roraima	RR		São Paulo	SP
	Pará	PA	South	Paraná	PR
	Amapá	AP		Santa Catarina	SC
	Tocantins	TO		Rio Grande do Sul	RS
Northeast	Maranhão	MA	Midwest	Mato Grosso do Sul	MS
	Piauí	PI		Mato Grosso	MT
	Ceará	CE		Goiás	GO
	Rio Grande do Norte	RN		Distrito Federal	DF
	Paraíba	PB			
	Pernambuco	PE			
	Alagoas	AL			
	Sergipe	SE			
	Bahia	BA			

Source: Author.